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Atmospheric Chemistry and Physics Discussions

Interactive comment on "In situ vertical profiles of aerosol extinction, mass, and composition over the southeast United States during SENEX and SEAC^{4}RS: observations of a modest aerosol enhancement aloft" *by* N. L. Wagner et al.

Anonymous Referee #1

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This paper uses aircraft observations from SENEX and SEAC4RS to investigate what fraction of aerosol mass and extinction in the transition layer over the southeastern U.S. can be attributed to mixing vs. production. It represents a clear and careful analysis of a very nice dataset. However I was disappointed that the study didn't really go the extra step to connect to the big picture question of aerosol sources and seasonality in the southeastern U.S. which served as motivation for the study (i.e. Goldstein et al.). The results beg several questions: (1) how representative was the summer of 2013? Are these results generalizable for the southeast? (2) what is the impact of this highly

selective analysis (sub-micron only, afternoon only, no biomass burning, no in-cloud) and how does this relate to average observed aerosol extinction in the region? The AERONET observation of Figure 13 suggest that the sampling may bias this dataset to low AOD, limiting it relevance to mean conditions. While these airborne campaigns provide a limited snapshot (which nevertheless should be mined further to identify the biases associated with the sub-sampling used here), there are longer term ground and satellite observations which should have been used to provide a wider context. Without such work to contextualize the results, the conclusions (line 3150 lines 17 onwards) are overstated.

1. Abstract: should state year of observations as well as campaign names

2. Page 3129, line 20; page 3130 line 17; page 3150, line 17: Goldstein et al., 2009 linked the seasonality of AOD to biogenic SOA. Ford and Heald concludes only that the observations support a significant summertime aerosol source aloft. They speculate that aqueous sources of SOA or H2SO4 from Criegee chemistry are possible sources, so it's erroneous to suggest that SOA was the hypothesis of this study.

3. Sections 2.1 & 2.2: Please indicate the collection efficiency of the AMS instruments used and how these two instruments differ on the two aircraft.

4. Page 3134, lines 1-5: state what wavelengths were used for the extinction measurements (here or in table)

5. Table 1 and 2: aerosol extinction is listed as "dry" although the text indicates measurements were taken at 3 RH conditions. Perhaps "dry" is meant to indicate the uncertainty under "dry" conditions? If so, uncertainties for "wet" should also be stated.

6. Table 1 and 2: Please harmonize instrument labeling: some are given in full (e.g. Aerosol Mass Spectrometer) and some are given as acronyms (e.g. PTR-MS)

7. Table 1 and 2: 5th entry should read "Dew Point (RH)" since the accuracy is given in units of dew point, not RH.

8. Section 2.4: would have been insightful for the authors to compare their extinction or total AOD values to other available datasets (CALIPSO, MODIS, or AERONET).

9. Section 2.4: Did the authors check if the fitted kappa is consistent with the measured composition?

10. Page 3136, line 27-28: awkward phrasing “globally and over the SEUS” suggests that the SEUS is not part of the globe. Suggest that this is re-phrased

11. Page 3137, line 10-11: Does “mixed layer height” mean top of the mixed layer? Please clarify.

12. Figure 3 caption (and generally all Figures): please specify which variables are measured and which are calculated.

13. Figure 4: It would be appropriate to use reduced major axis fitting here. Please specify in the caption/text if this is the case or correct if otherwise.

14. Page 3139, lines 21-22: ion charges missing on nitrate (NO3-), ammonium (NH4+), and sulfate (SO42-)

15. Page 3141, line 14: “virtual potential temperature was constant”. With what tolerance?

16. Section 4.1: Please comment on the impact of neglecting horizontal advection.

17. Section 4.1: Could you comment on how/whether this analysis of the fraction of air is affected by the lifetime of the assumed compound (i.e. CO) relative to the applied species (i.e. aerosols)?

18. Page 3145, lines 23-24: How does the vertical profile of aerosol mass/extinction differ when including biomass burning?

19. Page 3147, line 15: typo: eq (5)

20. Page 3147, line19-20: The authors might want to note that this approach is sup-

ported by their own analysis in Figure 4.

21. Figure 11: caption missing (caption is for Figure 12).

22. Figure 12: typo “total sulfur (tS).”

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 3127, 2015.